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Goldbach Conjecture Proof

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Abstract

The Goldbach conjecture was proposed by the German mathematician Christian Goldbach around the year 1742, to another well-known mathematician of that time Leonard Euler. The conjecture has been found to hold for all numbers up to 4 x 10^8 but remains unproven until now. This paper proves the Goldbach conjecture by showing that elements of the addition of two odd prime numbers produce elements of the resulting even number. The resulting element from the addition of two odd prime numbers evaluate to an equal amount thus proving that every even number can be expressed as the addition of two odd prime numbers.

Keywords: Number theory, Twin Prime conjecture and Polignac's conjecture.

MSC: 11-xx.

INTRODUCTION

The Goldbach conjecture is one of the oldest conjectures in mathematics. The problem statement is that every even number greater than two can be written as the sum of two odd prime numbers [2]. Two primes (p, q) subject to addition will always express an even number such that, $p + q = 2k = n$, where n, is even [1] [2] [3]. The following method shows that for every positive number n, there exists the statement of, $n = 2 - y$. The following also shows how for every even number n, there exists the statement of, $n = 2k$. There also exists the statement of $n = 2k + 1$, for every odd prime number. From these statements, values of the element k are found for every even number resulting from the addition of two odd prime numbers. From these y elements of k, ($y \epsilon k$) n elements of k, ($n \epsilon k$) are found. These n elements of k, then produce y elements of N, ($y \epsilon \mathbb{N}$) when substituted into n elements of $\mathbb{N}$, ($n \epsilon \mathbb{N}$) equations. These y elements of N are then evaluated with the even numbers to produce a successive y element of $\mathbb{N}$.

When this y element of $\mathbb{N}$ is evaluated with an even number, the n elements of $\mathbb{N}$ will be the same thus proving the conjecture.

METHOD

Finding the statement of $n = (2 - y)$, for all positive natural numbers of $\mathbb{N}$.

$(\forall n \epsilon \mathbb{N})\ (\exists y \epsilon \mathbb{N})\ (n = 2 - y)$.

$(\forall n \epsilon \mathbb{N})\ (n = 2 - y)$.

$n/2 + y/2 = 1$

$n/2 = 1 - y/2$

$n = 2(1 - y/2)$

$n = 2 - 2y/2$

$n = 2 - y$

Finding the k, element of $\mathbb{N}$, where $n = 2k$, for all even numbers.

$(\forall n \epsilon \mathbb{N})\ (\exists k \epsilon \mathbb{N})\ (n = 2k)$ for some number $(k \epsilon \mathbb{N})$.

For all even numbers.

$n = 2k = 2 - y$

Where;

$k = (2 - y)/2$

$k = 1 - y/2$

For all even numbers.

Finding the k, element of $\mathbb{N}$, where $n = 2k + 1$, for all odd prime numbers.

$(\forall n \epsilon \mathbb{N})\ (\exists k \epsilon \mathbb{N})$ written as $n = 2k + 1$, for all odd prime numbers $(k \epsilon \mathbb{N})$.

For all odd prime numbers.

$n = 2k + 1 = 2 - y$

Where;

$2k + 1 = 2 - y$

$2k = 2 - y - 1$

$2k = 1 - y$

$k = 1/2 - y/2$

For all odd prime numbers.

Adding two odd prime numbers together will result in a $(y \epsilon k)$ value for the resulting even number.

$2k + 1 + 2k + 1 = 0$

$2(1/2 - y/2) + 1 + 2(1/2 - y/2) + 1 = 0$

$(1 - 2y/2) + 1 + (1 - 2y/2) + 1 = 0$

$1 - y + 1 + 1 - y + 1 = 0$

$-2y + 4 = 0$

$-2y = -4$

$y = -4/-2$

$y = 2$

Substituting this $(y \epsilon k)$ from the addition of two odd primes as the $(y \epsilon k)$ for the resulting even number gives an $(n \epsilon k)$.

$n = 2k$

$= 2(1 - y/2)$

$= 2(1 - 2/2)$

$= 2\ (0)$

$n = 0$

Substituting the $(n \epsilon k)$ of the resulting even number from the addition of two odd primes into the $(n \epsilon \mathbb{N})$ gives a $(y \epsilon \mathbb{N})$.

$n = 2 - y$

$0 = 2 - y$

$0 - 2 = - y$

$- 2 = - y$

$- 2/- 1 = y$

$2 = y$

When $(n \epsilon k)$ equals zero, $(y \epsilon \mathbb{N})$ equals two.

Demonstrating that when the $n \epsilon \mathbb{N}$ is two the $y \epsilon \mathbb{N}$ will be zero.

$n = 2 - y$

$n - 2 = - y$

$2 - 2 = - y$

$0 = - y$

$0 / - 1 = y$

$0 = y$

Substituting the $y \epsilon \mathbb{N}$ into the $n \epsilon \mathbb{N}$ equation demonstrates the first even number two n

$\epsilon \mathbb{N}$ is the same.

$n = 2 - y$

$= 2 - 0$

$= 2$

$n = 2$

Demonstrating the proof for the first even number greater than two where the $(n \epsilon \mathbb{N})$ equals 4 and produces a successive $(y \epsilon \mathbb{N})$.

$n = 2 - y$

$n - 2 = - y$

$4 - 2 = - y$

$2 = - y$

$2 / -1 = y$

$-2 = y$

Substituting this $(y \epsilon \mathbb{N})$ into the $(n \epsilon \mathbb{N})$ equation $n = 2 - y$, proves the conjecture as the $(n \epsilon \mathbb{N})$ will be the same.

$n = 2 - y$

$= 2 - - 2$

$= 2 + 2$

$n = 4$

Q.E.D.

RESULTS

The $(y \epsilon k)$ produced from the addition of two odd prime numbers produces a y value of two. This $(y \epsilon k)$ produced from the addition of two odd prime numbers produces the $(n \epsilon k)$ for the resulting even number. When the $(y \epsilon k)$, is substituted into the even number statement of $n = 2k$, the result is zero. The $(n \epsilon k)$ substituted into the $(n \epsilon \mathbb{N})$ produces a $(y \epsilon \mathbb{N})$ that is two units greater than the $(n \epsilon k)$. When an even number is evaluated in the $n \epsilon \mathbb{N}$ equation a successive $y \epsilon \mathbb{N}$ is found. When this $y \epsilon \mathbb{N}$ is evaluated in the $n \epsilon \mathbb{N}$ equation both n elements are of equal value and are the same value of the even number being evaluated.

CONCLUSION

The addition of two odd prime numbers produces a $(y \epsilon k)$, that when substituted as the $(y \epsilon k)$ for the resulting even number results in zero and an $(n \epsilon k)$. This $(n \epsilon k)$ of zero is then substituted into the equation $n = 2 - y$ as the $(n \epsilon \mathbb{N})$ which finds the $(y \epsilon \mathbb{N})$ for the natural number. When evaluating an even number in the ($n \epsilon \mathbb{N}$) equation $n = 2 - y$, a successive ($y \epsilon \mathbb{N}$) is found. When this successive ($y \epsilon \mathbb{N}$) is evaluated again the ($n \epsilon \mathbb{N}$) are of equal value thus proving that for any given natural even number the ($n \epsilon \mathbb{N}$) will be of equal value when evaluated against the ($y \epsilon \mathbb{N}$). This is due to the fact there exist a statement of $n = 2 - y$ and the ($y \epsilon k$) for the addition of two primes equal two when the ($n \epsilon k$) is zero. Therefore, the successive ($y \epsilon \mathbb{N}$) decreases by two units of the even number being evaluated in the ($n \epsilon \mathbb{N}$) equation.

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Statements and Declarations

Data Availability

All data supporting the research is found within this research paper.

Conflicts of interest

The author declares no conflicts of interest.

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